

Programmable DC Power Supply with Active PFC



TC.GSX Series unit with optional Human Machine Interface (HMI)

Features

TC.GSX Series (with Active PFC)

- TopCon Grid-tie Source technology enables full Q1 mode operation
- Compact design with integrated EMI - and Sine filters
- Constant voltage (0 – 100 %), constant current (0 – 100 %) and constant power operation (5 – 100 %) with automatic and fast crossover and mode indication. Internal resistance simulation.
- Graduated product line: 65 V_{DC}, 130 V_{DC}, 400 V_{DC}, 500 V_{DC}, 600 V_{DC}, higher voltages with series connection up to 1500 V_{DC}. Power categories of 20 kW and 32 kW are available for each nominal output voltage.
- Optional extras and accessories complete the product line of power supply units.
- Modular concept for easy power increase: Parallel, series, matrix or multiloading master-slave-operation.
- High efficiency at a low cost, resulting from the application of innovative IGBT and transformer technology. Primary switched. Galvanic isolated. Full digital control and regulation.
- A user-friendly PC program, the operating and service software TopControl, enables the user to communicate with the power supply.
- TopControl installation file, LabVIEW® and C/C++ C#/ .NET API (DLL file) are included in the scope of delivery.
- CE conformity
- Swiss made: Developed, manufactured and tested in Switzerland by Regatron AG.

Technical Data

AC lineside ratings

Line voltage / Line current relationship

| | |
|--|--|
| | 3 x 380 V _{AC} ± 10 % / 34 Arms ^{1) 13)} |
| | 3 x 400 V _{AC} ± 10 % / 32 Arms ¹⁾ |
| | 3 x 415 V _{AC} ± 10 % / 31 Arms ¹⁾ |
| | 3 x 440 V _{AC} ± 10 % / 29 Arms ¹⁾ |
| | 3 x 460 V _{AC} ± 10 % / 28 Arms ¹⁾ |
| | 3 x 480 V _{AC} ± 10 % / 27 Arms ¹⁾ |

Line frequency 48 – 62 Hz
 Mains connection type 3L + PE (no neutral)
 Protective conductor current @ 50 Hz < 20 mA ²⁾
 Touch current unweighted < 20 mA ²⁾
 Touch current weighted < 2 mA ²⁾
 Powerfactor Q1-mode @ P_{nom} ≥ 0.99
 Efficiency at nominal power Q1 91.5 % ⁹⁾

DC loadside ratings

| | |
|-------------------------------------|-------------------------------|
| Power range | 0 kW – 20 kW ³⁾ |
| Voltage range | 0 VDC – 600 VDC |
| Current range..... | 0 A – 40 A ³⁾ |
| Internal resistance range | 0 mΩ – 15000 mΩ ⁴⁾ |
| Switchable output capacitance | 0.09 mF / 0.9 mF |

Static accuracy

| | |
|-----------------------------|----------------------------|
| Load regulation CV, CC..... | < ± 0.1 % FS ⁵⁾ |
| Line regulation CV, CC..... | < ± 0.1 % FS ⁶⁾ |

Transient response time

| | |
|--------------------------------|----------------------------|
| Load regulation CV | < 1.1 ms ⁷⁾ |
| Set value tracking CV | < 1.1 ms ^{8) 11)} |
| Set value tracking CC: | |
| -With quadrant change | < 3 ms ⁸⁾ |
| -Without quadrant change | < 2 ms ⁸⁾ |

Stability

| | |
|-------------------------------|------------------------------|
| Voltage regulation (CV) | < ± 0.05 % FS ¹⁰⁾ |
| Current regulation (CC) | < ± 0.05 % FS ¹⁰⁾ |

Ripple Q1 Mode

| | |
|---------------------------------|---------------------------|
| ≤ 300 Hz V _{pp} | < 0.5 % FS ¹¹⁾ |
| ≤ 300 Hz V _{rms} | < 0.1 % FS ¹¹⁾ |

Noise Q1 Mode

| | |
|---------------------------------------|------------------------|
| 40 kHz – 1 MHz V _{pp} | < 1 V ¹¹⁾ |
| 40 kHz – 1 MHz V _{rms} | < 0.2 V ¹¹⁾ |

Temperature coefficient

| | |
|-------------------------------|--------------------------------|
| Voltage regulation (CV) | < 0.02 % FS / K ¹²⁾ |
| Current regulation (CC) | < 0.03 % FS / K ¹²⁾ |

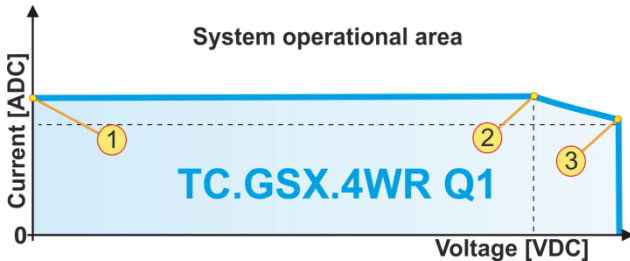
1) At nominal output power and nominal line voltage. Soft-start to limit turn-on surge currents.
 2) According to IEC60990: Protective conductor current: 50 Hz component @400 VAC/50Hz/P_{nom}
 For weighted touch current: Measured for perception/reaction
 Protection with earth leakage circuit breaker possible. An additional PE connection is necessary.
 3) Current according to the given power limit of the corresponding units.
 (P = V_{Load} * I_{Load} ≤ 20 kW; for I_{Load} > 34 A --> V_{Load} < 600 V).
 4) The maximum value of the internal resistance is automatically calculated via the DC nominal values
 (Ri [mΩ] = V_{Load} / I_{Load} = 600 VDC / 40 A) or limited by the maximum Ri-value: 32000 [mΩ].
 5) Typical value for 0 – 100 % load variation, at constant line input and temperature conditions.
 6) Typical value for input voltage variation within 380 VAC ± 10 % – 480 VAC ± 10 %, at constant load and temperature conditions.
 7) Typical recovery time to within < ± 5 % band of set value for a load step 10 – 90 %, ohmic load, at constant line input and temperature conditions. Transient response time can be slightly affected by multi-unit operation.
 8) Rise/ fall time for 10%-90% of a set step.
 9) At 15kHz switching frequency line side inverter.
 10) Maximum drift over 8 hours after 30 minute warm-up time, at constant line input, load and temperature conditions.
 11) Typical value at nominal ohmic load, line asymmetry < 1 V_{rms}.
 12) Typical change of output values versus ambient temperature, at constant line input and load conditions
 13) Information about derating see section Deratings on page 2.

Non-ohmic loads can lead to deviations in the technical data. All product specifications are subject to change without notification.

Technical Data

Operating modes

| | |
|-------------------------------|----------------|
| Q1 mode | source mode |
| Voltage regulation (CV) | 0 – 100 % Vnom |
| Current regulation (CC) | 0 – 100 % Inom |
| Power regulation (CP) | 5 – 100 % Pnom |



Q1 range of device TC.GSX.20.600.4WR.S.

Quadrant Q1:

| | |
|-----------|----------------|
| -1- | 0 V / 40 A |
| -2- | 500 V / 40 A |
| -3- | 600 V / 33.3 A |

Remote sensing

| | |
|--------------------------------|------|
| Line voltage drop compensation | |
| Terminal on rear side | X104 |

Deratings

Power derating

None.

Current derating

None.

Isolation

| | |
|----------------------------|--------------------------------------|
| Line to case/logic | 1670 VDC 1 s |
| Output to case/logic | 2540 VDC 1 s |
| Transformer | 4800 VAC |
| Output to case | 10.8 MΩ / high impedance (X109 open) |
| per DC bar | 13.6 nF |
| - bar ¹⁾ | +1000 VDC / -1000 VDC |
| + bar ¹⁾ | +1000 VDC / -1000 VDC |

Technical Data

Protection

Built-in protection

| | |
|----------------------------------|-----------------|
| Overtemperature | |
| Overvoltage (programmable) | 0 – 110 % Vnom |
| Response time | 50 μs – 1600 ms |
| Overcurrent (programmable) | 0 – 110 % Inom |
| Response time | 50 μs – 1600 ms |

Max. reactive load voltage ≤ 110 % Vnom
 Short circuit protection Cont. short circuit allowed
 Islanding, grid off, requirements for the connection of
 micro-generators in public grid according
 VDE 0126/EN 50438.

Internal diagnostics

line input conditions, transformer primary current,
 temperature conditions, processor idle time, system
 configuration, system communication, sensor signals,
 power semiconductor temperatures.

Type of protection (according EN 60529)

| | |
|--------------------------|--|
| Basic construction | IP 20 (current bars on rear side excluded) |
| Mounted in cabinet | Up to IP 54 |

Conformity CE-Marking

EMC Directive 2014/30/EN

| | |
|---|--------------|
| Generic standards – Emission standard for industrial environments | EN 61000-6-4 |
| Generic standards – Immunity standard for industrial environments | EN 61000-6-2 |

Low Voltage Directive 2014/35/EU

| | |
|--------------------------------------|----------|
| Electronic equipment | |
| for use in power installations | EN 50178 |

RoHS Directive 2011/65/EU

Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Ambient conditions

Operation

| | |
|--|-----------|
| Operating temperature | 5 – 40 °C |
| Relative air humidity (non-condensing) | 0 – 95 % |

Storage

| | |
|--|-------------|
| Storage temperature (with coolant) | -18 – 70 °C |
| Relative air humidity (non-condensing) | 0 – 95 % |

| | |
|--------------------------------------|----------------------------|
| Installation altitude | 0 - 2000 m above sea level |
| Operating orientation | upside |
| Storage, transport orientation | upside |

Utilization category

| | |
|----------------------------|-----|
| Protection class | I |
| Overvoltage category | III |
| Degree of pollution | 2 |

Cooling

Internal liquid to air heat-exchange system using temperature-controlled fans.
 Coolant Antifrogen® N Clariant

1) Maximum working voltage including DC output voltage.

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Standard Interfaces

RS232

9 pin D-sub connector, female on front panel
 Isolation to electronics and earth 125 Vrms
 Baud rate 38400 baud

Resolution (programming and readback):

V, I 0.025 % FS
 P, Ri 0.1 % FS

I/O Interface X105 (analog / digital)

25 pin D-sub connector, female on rear panel
 Isolation to electronics and earth 125 Vrms

Control port input functions

Output voltage off / on 0 / 24 VAC / DC
 2 digital application inputs 0 / 24 VAC / DC ¹⁾
 Interlock circuit 0 / 24 VDC
 Voltage setting 0 % – 100 % 0 V – 10 V
 Current setting 0 % – 100 % 0 V – 10 V
 Power setting 0 % – 100 % 10 V – 0 V ²⁾
 Int. resistance setting 0 % – 100 % 0 V – 10 V
 Input impedance analog inputs 20 kΩ

Control port output functions

Unit ready / error Relay contact
 Output voltage on Relay contact
 Warnings Relay contact
 Actual voltage readback 0 % – 100 % 0 V – 10 V
 Actual current readback 0 % – 100 % 0 V – 10 V

Resolution (programming and readback):

V, I, P, Ri 0.2 % FS

User Software

Software TopControl

The user-friendly operating and service program
 TopControl is included in the scope of delivery.



- Remote connection via PC interfaces: E.g. RS-232 or USB interface (Option) and further interface options.
- System operation (parallel or serial mode)
- Q1 (source) and Q4 (sink) operation modes.
- TopControl is the user interface software and environment for the additional software option like TFEAAP (FUNGEN) or CANmp.

Options Unit

Displays

Human machine interface unit (HMI)

Integrated control, programming and display unit with graphic LC-Display, select wheel, push buttons and interactive text menus
 Languages (switchable) English, German

Display resolution:

U 4 digits
 I 3 digits
 P Kilowatt + 1 decimal digit
 Ri 1 mΩ

Remote control unit (RCU)

Specifications same as HMI, available in 2 versions:
 Desktop W x H x D 355 x 100 x 290 mm
 19" Rack-Mount W x H x D 483 x 88 (2 U) x 290 mm

Interfaces

On rear panel

USB
 ETHERNET
 TC.LXI
 IEEE 488.2 / GPIB / SCPI
 cannot be combined with CANOPEN nor with USB
 CANmp Fast multi-protocol CAN
 CANOPEN
 RS232REAR ³⁾
 OptoLink fibre optic interface
 OptoLink / RS232 ³⁾ fibre optic interface incl. RS232
 RS422 ³⁾

Software

TFEAAP ¹⁾ TopCon Function Generating Engine
 Time-based and parametric programming
 PV curves or user defined curves (csv files)
 SASControl ¹⁾ SAS application program
 including TFEAAP
 BatControl ¹⁾ Battery testing program
 BatSim ¹⁾ Battery simulation program
 CapSim ¹⁾ Capacitor simulation program

Safety

ISR ⁴⁾ 2 channel Integrated Safety Relay
 VLI Voltage Level Indicator
 RPP ⁴⁾ Reverse Polarity Protection
 PACOB DC Protection against accidental contact
 PACOB AC Protection against accidental contact

1) Customer-specific programmable
 2) For the Q1 range only power settings +10 ... 0 V possible.
 3) This option and RS232: time-shared mode required, if use together.
 4) Retrofitting on request

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Options Unit

AIRFILTER

Front panel airfilter 9 U

Derating

None.

LC (Liquid Cooling)¹⁾

Integrated liquid cooling system of the power stage with completely integrated liquid to liquid heat-exchange system.

Specifications

Material²⁾ Stainless steel
 Inlet/outlet on rear side size G 1/2"
 Liquid temperature 15³⁾ – 35 °C
 Flow ≥ 3 l / min
 Recommended flow 4 - 6 l / min
 Pressure max. 8 bar
 Pressure drop 50 mbar @ 3 l/min

Miscellaneous

NSOV Non-Standard output voltage (if possible)
 NSOC Non-Standard output current (if possible)
 NSOP Non-Standard output power (if possible)

Options System

System operation

CANCABLE

Connecting cable for Multi-Unit Systems or RCU
 Cable length 2, 5, 10, max. 40 m

TC.MAC (Master Array Controller)

Required for Multi-Unit Systems with more than 16 power supplies. Controls several subsystems of up to 16 power supplies to reach MW range.
 MACInterface Interface for using TC.MAC
 MACCABLE To connect Subsystem to TC.MAC
 Cable length 2, 5, 10, max. 40 m

General Data

Weight & Dimension

Weight 97 kg
 Width front panel (19") 483 mm
 Width housing 444 mm
 Height front panel (9U) 399 mm
 Height housing 394 mm
 Depth with output terminals 634 mm
 Depth housing 594 mm

Terminals

AC

Terminal block 4 x 25 mm²

DC

Material nickel-plated copper bars
 Dimensions 40 mm, 1 hole 9 mm Ø in each bar

Scope of delivery

RS232 cable 1.8 m
 Dummy plugs X101 and X105
 Operating manual English or German
 Installation disc TopControl
 DLL files LabVIEW® and C /C++ / C# / .NET API

Ordering code

TC.GSX.20.600.4WR.S (.Option)

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1 Retrofitting on request
 2 Ni brazed, ready to use with deionized water
 3 20 °C ambient temperature and ≤ 70 % relative air humidity

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